City of Wichita

Homeowners Guide for Installing Electrical Wiring

Office of Central Inspection

Electrical Section

455 N. Main - 7th Floor

Wichita, Kansas 67202

(316) 268-4465

www.wichitagov.org

TABLE OF CONTENTS

CAN A HOMEOWNER INSTALL THEIR OWN ELECTRICAL WIRING IN THE CITY OF WICHITA?

The Answer Is <u>Yes</u>! The Office of Central Inspection has provisions available for a owner occupant of a single family residence to install their own electrical wiring. This program is designed to deliver better service for homeowners seeking to remodel, add on, or alter their residence in the City of Wichita. It also helps to ensure that the electrical wiring is installed in a safe and efficient manner and that the installation meets the requirements of the Electrical Code of the City of Wichita. The electrical section of OCI is responsible for this program and has assisted many homeowners in this endeavor. We are committed to providing the highest quality service and assistance that we can.

How Do I Know If I Qualify? First of all, you must be the ***owner-occupant of a single family dwelling***. This means that you cannot install wiring in any rental property that you may own, or in any duplex, triplex, etc. that you may own and live in. This only applies to the owner occupant of a **single** family dwelling. Second, you must take and pass a simplified electrical wiring examination. This exam is given over the edition of the National Electrical Code (NEC) currently adopted by the City of Wichita. The exam questions are taken from the residential part of the NEC and are designed to inform the homeowner of important installation requirements of the Code as they relate to residential wiring. Also, you must submit a wiring diagram that indicates the areas where the wiring is to be installed. On the drawing you must show the dimensions of the areas involved and where the receptacles, light fixtures, switches and all other wiring is to be located. One of the Electrical Inspectors (usually the same inspector that will be making the inspection), will then review the drawing with you, make any necessary revisions required and answer any questions that you may have, and send you home with information that will be beneficial to you during your installation. The plan review is a very important part of the procedure, because it not only benefits the homeowner, but also the inspector. After you install the wiring, you call for your inspection. You must call at least one day in advance to schedule the inspection. The inspector will meet you at your residence and make the inspection with you. This works very well, because if any corrections are needed, they can be pointed out and explained to you at that time. When the corrections are made, you call and reschedule another inspection.

Are There Any Restrictions? <u>Yes!</u> The City Ordinance does not allow the homeowner to install any electrical wiring on the <u>*line side*</u> of the electrical service. This includes the meter enclosure, service conduit or risers, and the service (breaker) panel. The reason for this restriction is because this part of the service is not protected by any overcurrent devices (circuit breakers or fuses). Therefore, due to the potential hazard involved in this part of the wiring, if the electrical service needs to be changed, altered, or a new service installed, a licensed Electrical Contractor of the City of Wichita ***<u>must</u>*** perform this work. However, you as a homeowner may install all other wiring on the <u>*load side*</u> of the electrical service (breaker) panel. This includes installing the branch circuit wiring and all the devices (receptacles, switches, fixtures, circuit breakers, etc.) associated with it.

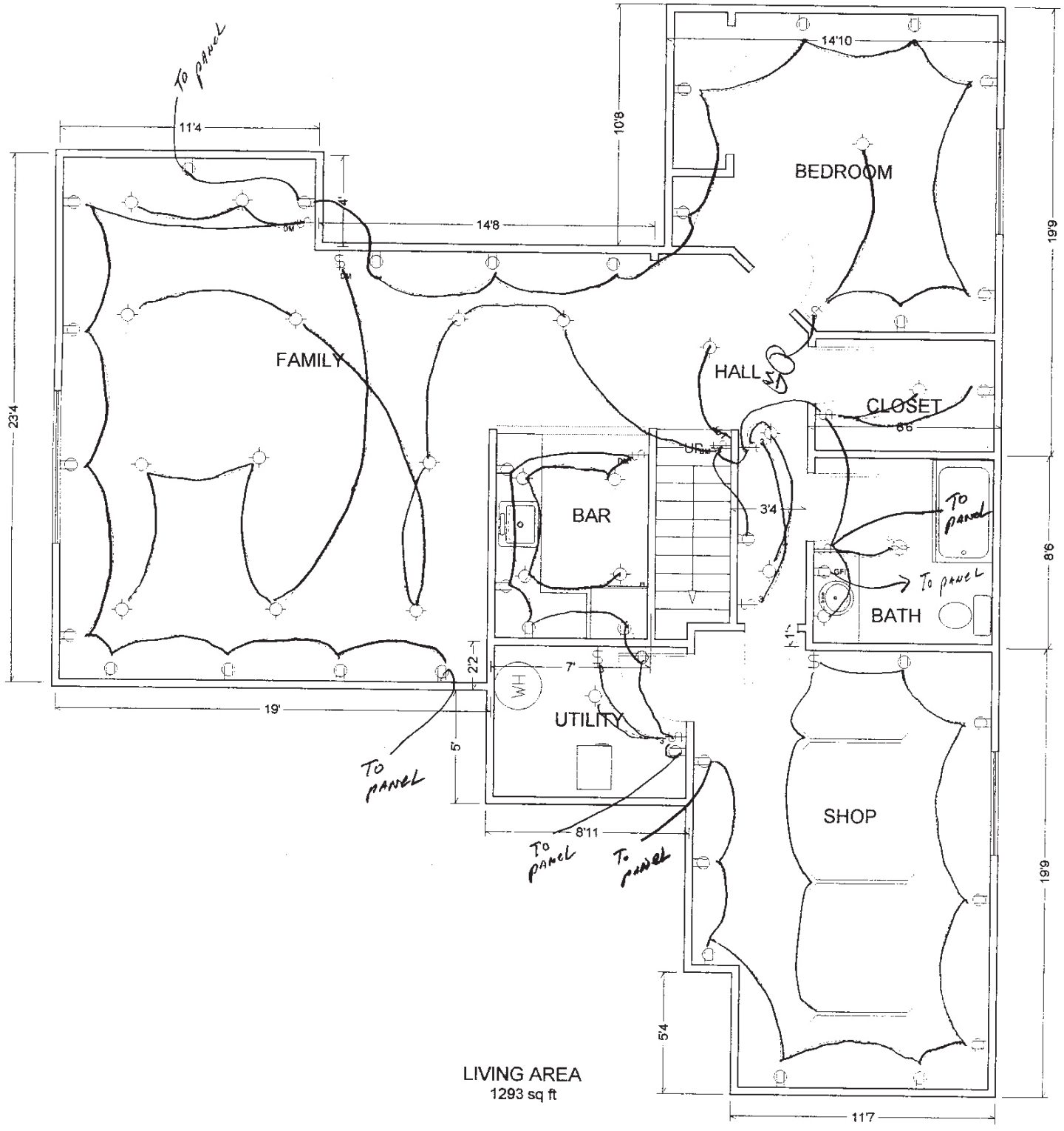
What Permits Are Required? An electrical permit is required. However, if a building permit is also required, the electrical permit is obtained at the time that the building permit is issued. If a building permit is not required, then you must obtain the necessary electrical permit. Permit application forms are available in OCI for this purpose. A separate minimal fee is also required for the examination and the plan review.

How Do I Get Started? After you have decided to proceed, the first thing that you need to do is take out your permit. You get this at 455 N. Main, 7th Floor, Office of Central Inspection. The permit desk is open from 8:00am - 4:45pm Monday thru Friday. Then contact the Electrical Section of OCI and schedule to take the simplified homeowner's electrical exam. This is a 25 question open book exam with a 3-hour time limit.The examination is given any morning, Monday through Friday, beginning between 7:30 - 8:00 am. The examination is administered by the Electrical section of OCI, and the exam questions are taken from the latest adopted edition of the National Electrical Code (NEC). There is a $25.00 fee to take the test. If you wish to review the NEC prior to taking the examination, copies may be obtained at the City Library, or they are available for purchase in our office.

After successfully passing the test you will need to schedule for your plan review. The plan review is also done at City Hall between 7:30 - 8:00am. This normally takes between 20 and 30 minutes. This is a drawing showing all the receptacles, lights, switches, etc. and lines drawn showing the circuitry. The drawing does not need to be professionally done, but it does need to show room dimensions, door openings and closets. **There is a sample drawing on the next page.**

For additional information concerning the examination process, CALL 268-4465, 7:30 - 4:30 PM, Monday - Friday.

Sample Plan Review Drawing



HOUSEHOLD CIRCUITS

The service panel divides electrical current into branch circuits, usually referred to as "circuits." To fully understand your home's electrical system, learn where each circuit goes and which outlets it supplies. A typical 120-volt circuit serves several receptacles and or lights, but most 240-volt circuits supply only one appliance each.

Three Types of Branch Circuits

The NEC divides household circuits into three categories. A well-planned system will have these three types clearly laid out.

General-Purpose Circuits: These 120-volt circuits, usually 15 or 20 amp, supply a number of receptacles used for lighting and small appliances. Because most lights use only a small amount of power, a single circuit can supply power to quite a few. Many electricians prefer to assign a circuit only to permanent lighting or only to receptacles, however the NEC does permit receptacles and light fixtures to share the same circuit in the case of general purpose branch circuits.

Small-Appliance Circuits: These 120-volt circuits supply power to receptacles to which small appliances such as toasters, coffee makers, food processors, etc. will be connected. Usually, these circuits serve a reserved area, such as a kitchen for example. A typical kitchen will have at least two of these type of 20-ampere branch circuits.

Individual Circuits: These type of circuits supply only one appliance, and generally those that use a lot of power. For instance, a single-use 120-volt circuit may supply a dishwasher, a trash-compactor, a washing machine, or an older microwave oven. Large appliances, such as clothes dryers, electric ranges, water heaters, and large air conditioners, in most cases require their own individual 240-volt branch circuit.

Amps, Volts, and Watts

Think of electricity as similar to water in a plumbing system; a wire acts like a pipe to contain the flow of the water;

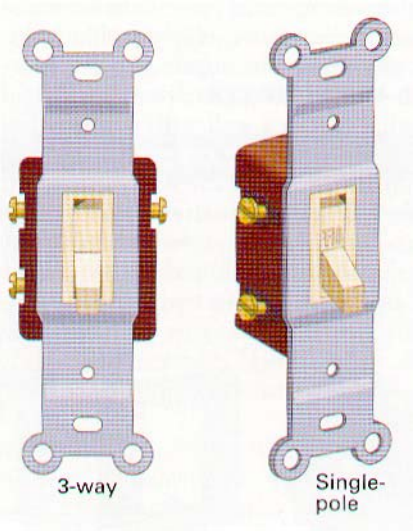
AMPS MEASURE CURRENT: The volume of the current (the number of electrons flowing past a given point per second) is measured in amperes, or amps.

VOLTS MEASURE PRESSURE: The pressure under which electricity moves is measured in volts. Electricity arrives at household circuits at a "pressure" of 120 or 240 volts.

WATTS MEASURE POWER: Power is measured in watts, and you can compute wattage by multiplying amperage and volts. For example, a standard light bulb drawing 1/2 amp from a 120-volt circuit uses 60 watts of power (120 volts x 0.5 amps = 60 watts). To calculate amps, divide watts by volts. For instance, a clothes dryer that uses 240 volts and is rated at 7,200 watts pulls 30 amps (7,200 / 240 = 30). This means that the dryer must be protected by a 30-amp circuit breaker, and the wire carrying current to it must be No. 10 copper, which is rated for 30 amps.

SWITCHES

At its most basic, a switch opens and closes a wiring loop to shut off and turn on a light, fixture, or appliance. However, there are many variations on this basic theme. The most common switches used will be single pole, three-way and four-way.



Single-Pole: Chances are, four out of five of your switches will be this type. A "single pole" switch is a "two-way" switch, which means that it has two settings (on and off) and two terminals.

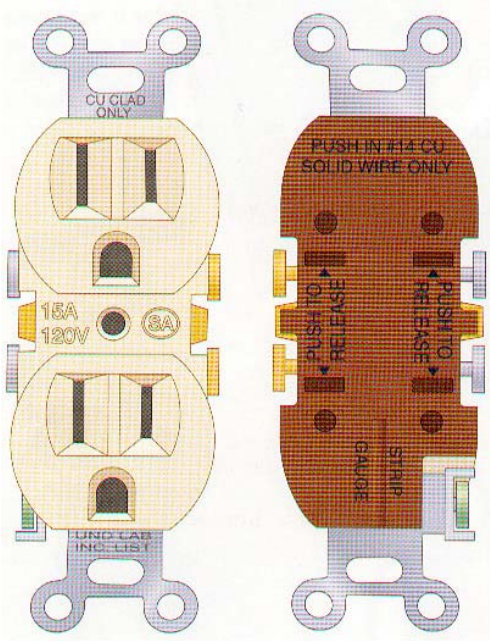
Three-Way: Use two, three-way switches to control a light from two different locations. A "three-way" switch has three terminals, which means it has three terminals but two settings and does not have ON and OFF marked on the switch.

Four-Way: A "four-way" switch has four terminals, but again only two settings. These type of switches are used along with three-way switches to add more switches controlling the same light. They also are not marked ON and OFF on the switch.

There are also many other "special-use" switches, such as:

Double-Switch: It fits into the same space as a single switch.
Dimmer Switch: These type of switches allows you to increase or decrease the intensity of the light and to turn it on and off. You can also purchase three-way dimmer switches to control a light from two locations.
Pilot-Light Switch: This type of switch has a bulb that glows when the switch is on. It is used for example when the fixture or light is not visible from the switch location, such as an attic fan or garage light.
Timer-Switch: These switches have dial controls that tells a fixture to turn off or on after a certain time interval, or to turn a light on and off at the same time every day.
Motion-Sensor Switch: This type comes equipped with an infrared "eye" that gazes over a wide area to detect motion and turn on the light. Some can be adjusted to sensitivity.

125-Volt RECEPTACLES

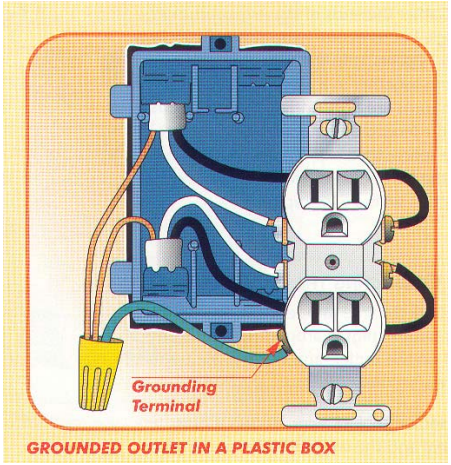


While other configurations are available, these are the types used in most homes.

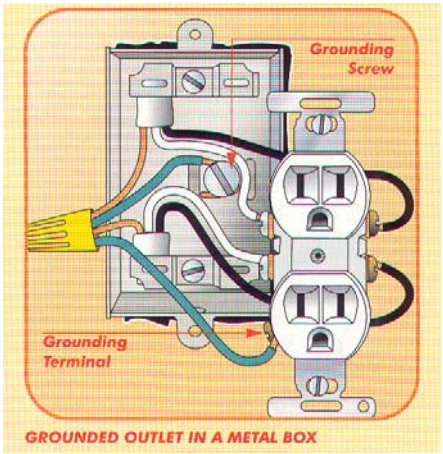
Information printed on the front and back of a receptacle tells you the amperage rating, the wire size, and how much insulation to strip off the wires. Look for certification from a testing agency. The most common of these have two outlets. Many styles have a metal tab that connects the two. Cut it to wire each outlet to a separate circuit. To ensure grounding and polarization, connect the white wire (neutral conductor) to the outlet's long slot terminal, the black wire (hot conductor) to the short slot terminal, and the bare or green wire (grounding conductor) to the green grounding screw terminal.

HOW TO GROUND AN RECEPTACLE OUTLET

In a metal box (right, below), a properly grounded outlet has two jumper wires (green) joined to the bare wires in the junction box by a wire-nut connector. One jumper, goes to the grounding screw at the back of the metal junction box. The other grounding jumper wire connects to the receptacle outlet's grounding terminal. In a non-metallic box (left, below), the wiring is identical, except that there is no grounding jumper to the box (because the plastic j-box is non-conductive).



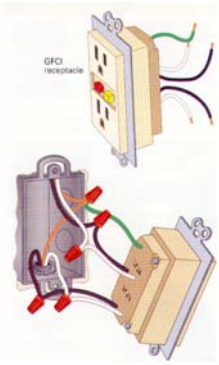
GROUNDED OUTLET IN A PLASTIC BOX



GROUNDED OUTLET IN A METAL BOX

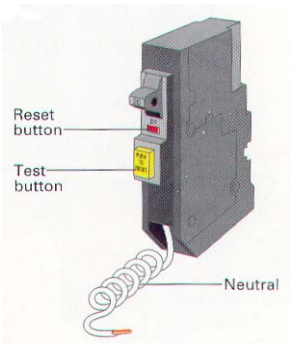
GFCI's
(GROUND-FAULT CIRCUIT INTERRUPTERS)

How a GFCI works: Electricity travels in circuits. It flows, for example, from a wall receptacle through a turned-on appliance and then back to the receptacle. Normally, the same amount of electricity that flows *from* the receptacle *returns* to the receptacle. But what if there is a leak (a loss of current escaping from the normal flow of electricity) because of a ground fault in the appliance. In that case, the same amount of current will not flow back to the receptacle. If the flow loss is as much as 5 milliamps, the GFCI shuts off the electrical power to the receptacle within 1/40th of a second, which is about 30 times faster than a heartbeat! Normally fast enough to prevent serious injury.



GFCI Receptacle

Test monthly



GFCI Circuit Breaker

How dangerous are ground-fault shocks? Ground-fault shocks range from a light tingle, to almost instantaneous electrocution. 10 milliamps of ground-fault shock, which is 10/1000 of an ampere; not even enough to light a Christmas tree light bulb, can cause a muscle contraction that will keep the victim from releasing his grip on the faulty device or wire. This is called "let go current." 30 to 200 milliamps makes breathing difficult and unconsciousness possible. 380 milliamps, only 1/3 of an amp; barely enough to light a 60 watt light bulb, can kill.

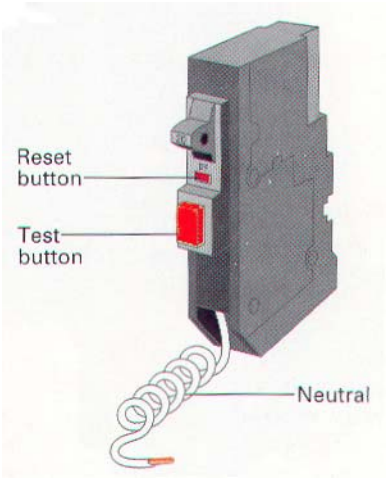
GFCI protection is the answer: As you can see, even a low-amperage ground-fault shock can be deadly. But a ground-fault circuit interrupter can safely limit the duration of ground-fault shock exposure.

But I have circuit breakers and fuses. Do I need a GFCI too? Conventional circuit breakers or fuses protect your electrical wiring against excessive heat caused by circuit overloads and short circuits. They do not protect you against the hidden hazard of a ground-fault. That's because their normal current ratings of 15 to 20 amps in residential applications, are much higher than the low-level current leakage common to ground faults. But the big difference is that Ground Fault Circuit Interrupters (GFCI's) monitor low-level current ground faults. They shut power off to a faulty circuit at a much lower current flow than fuses or circuit breakers. As low as 5/1000 (.005) amps. And that's well below the "let-go current" mentioned above.

Won't my "grounds" protect me against ground-fault? Your "grounds", which are the third-wire grounding conductors, grounding plugs, and equipment ground wires, theoretically will carry the leaking current harmlessly back to ground. But if the ground wire becomes broken or improperly installed, it could not protect you. *So the answer is no, your green-wire grounds cannot always protect you against ground faults.*

AFCI's
(ARC-FAULT CIRCUIT INTERRUPTERS)

Definition: Arc-Fault Circuit Interrupter: An arc-fault circuit interrupter is a device intended to provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to de-energize the circuit when an arc fault is detected. This will greatly help in the prevention of electrical fires.



Why use the Arc-Fault Circuit Interrupter? The basic objective is to de-energize the branch circuit when an arc fault is detected. Arc-fault circuit interrupters are evaluated in UL 1699, *Standard for Arc-Fault Circuit- Interrupters*, using testing methods that create or simulate arcing conditions to determine the product's ability to detect and interrupt arcing faults. These devices are also tested to verify that arc detection is not unduly inhibited by the presence of loads and circuit characteristics that may mask the hazardous arcing condition. In addition, these devices are evaluated to determine resistance to unwanted tripping due to the presence of arcing that occurs in control and utilization equipment under normal operating conditions or to a loading condition that closely mimics an arcing fault, such as a solid-state electronic ballast or a dimmed load.

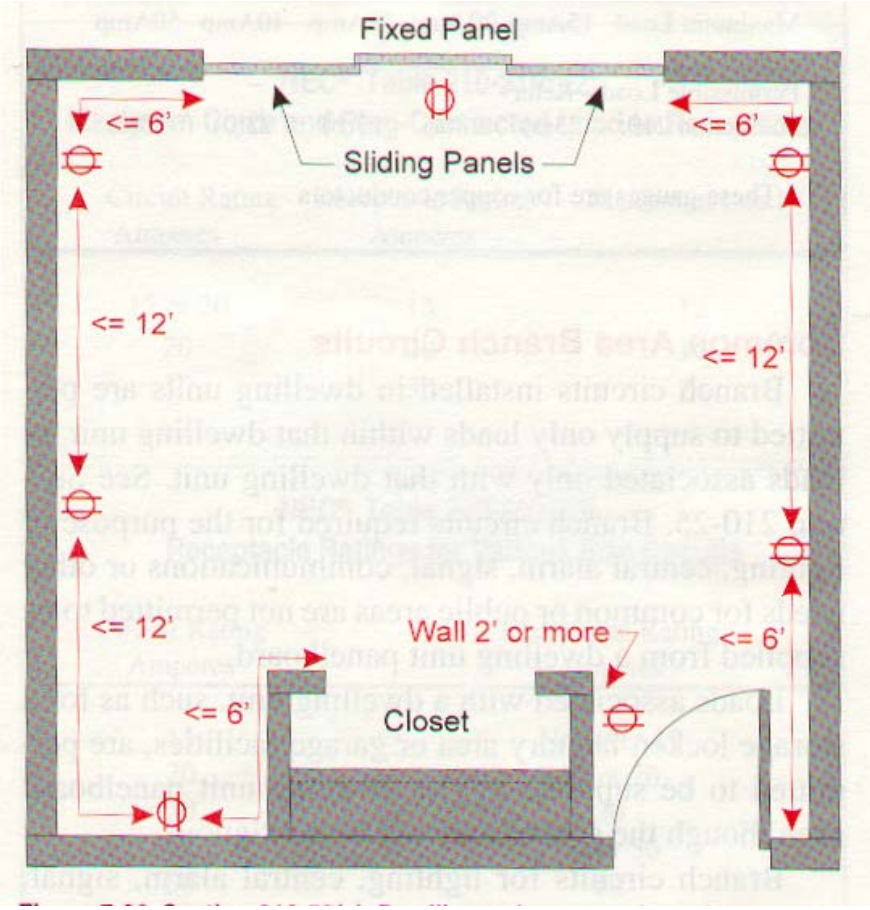
Where are AFCI's Required? Section 210.12(B) requires that AFCI protection be provided for all 15- and 20-ampere 120-volt branch circuits that supply outlets (including receptacle, lighting, and other outlets) in **dwelling unit bedrooms** regardless of whether the circuit supplies only outlets in the bedroom(s) or supplies outlets in the bedroom and other areas of the dwelling. Bedrooms contain readily ignitable cloth and cotton materials, and occupants my be sleeping when ignition occurs and not likely able to take protective action rapidly. Because circuits are often shared between a bedroom and other areas such as closets and hallways, providing AFCI protection on the complete circuit would comply with 210.12. There is no prohibition against using AFCI protection on other circuits or in locations other than bedrooms.

Does the AFCI need to be a circuit breaker? The protection requirement is for the entire branch circuit. The location of the device at the point the branch circuit originates (service or feeder panelboard or similar distribution equipment) continues to be the main requirement. However, the new exception permits the AFCI device to be located in close vicinity to the point of origin as long as the branch-circuit conductors that are not AFCI protected do not exceed 6 ft in length and the portion of the circuit between the point of origin and the AFCI location is installed in a metal raceway or a metallic-sheathed cable.

DWELLING UNIT RECEPTACLE OUTLET REQUIREMENTS

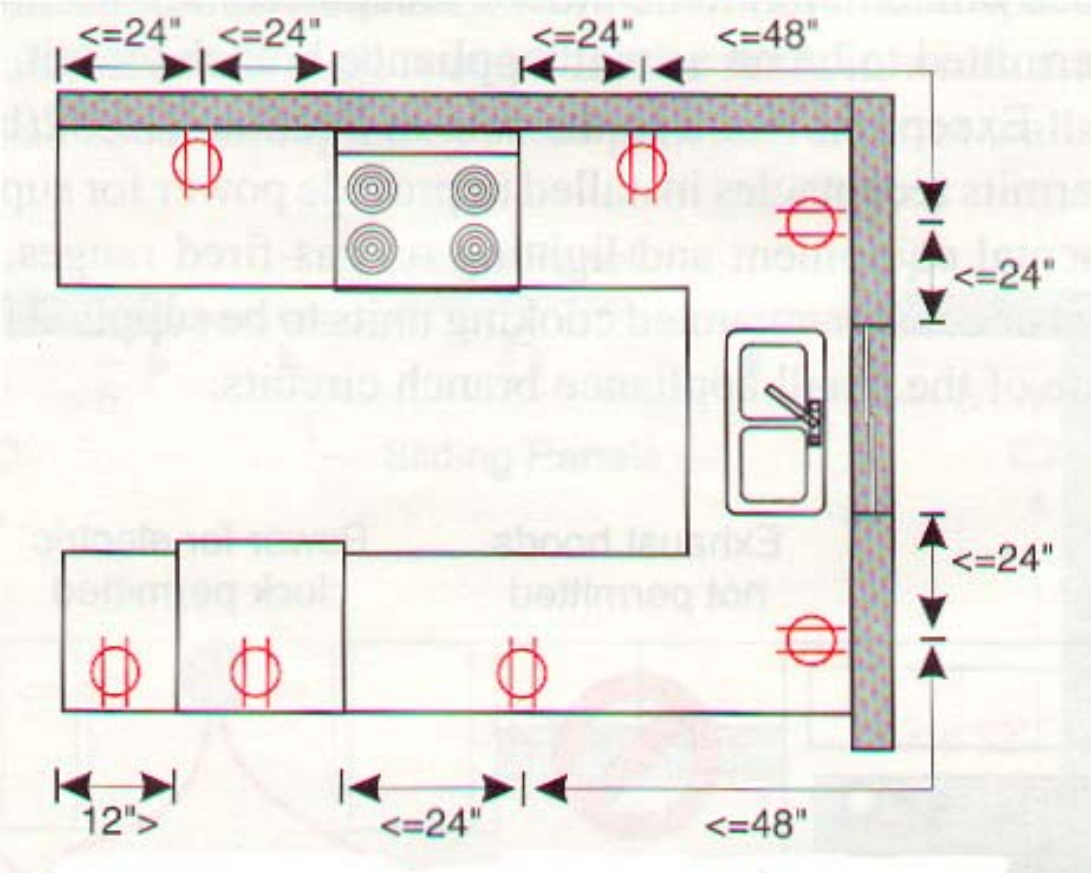
Dwelling Unit Receptacle Outlet Placement: (See room-layout below). A receptacle outlet must be installed so that no point along the wall space will be more than 6 feet (measured horizontally) from a receptacle outlet. This applies to; kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, sun rooms, bedrooms, recreation rooms, and other similar rooms or areas.

Wall Space: Wall space is considered walls, fixed exterior glass panels, bar-counter and **railings** that are at least 2 feet long, and unbroken along the floor line by doors or fireplaces. Sliding portion of sliding glass doors on exterior walls are not considered wall space.



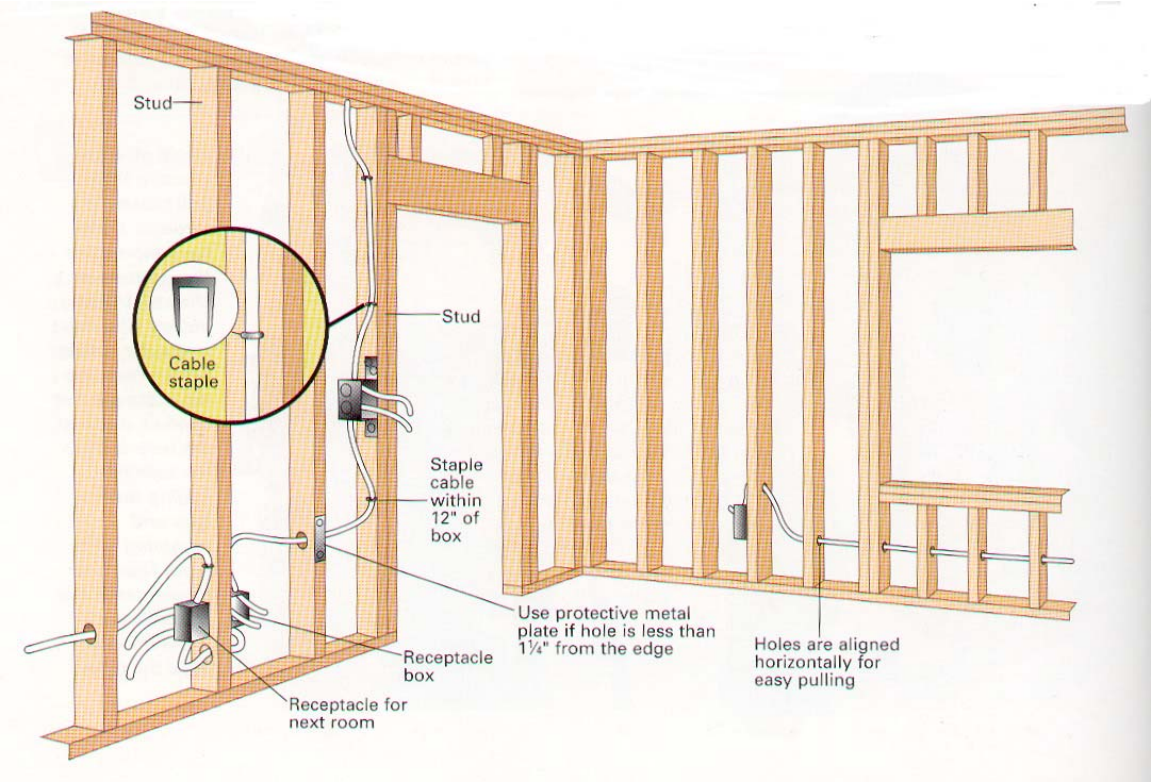
RECEPTACLE OUTLET REQUIREMENTS -- KITCHEN

Dwelling Unit Small Appliance Outlets: In the kitchen, pantry, breakfast room, dining room, or similar areas of a dwelling unit, two or more small appliance branch circuits are required to serve countertop and other receptacle outlets. The two 20- ampere small appliance circuits required in for these areas cannot supply any other outlets. This means that the kitchen light cannot be connected to the small appliance receptacle circuit.

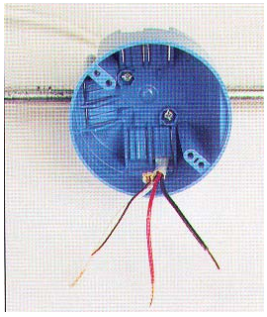


Location of Kitchen Counter-Top Receptacles: In kitchens and dining areas of dwelling units, a receptacle outlet must be installed at each wall counter space 12 inches or wider. In addition, receptacle outlets must be installed so no point along the wall line is more than 24 inches measured horizontally from a receptacle in that space. For applicable wall counter spaces, this means the first receptacle must be located not more than 24 inches from the edge of the counter space, and the next receptacle can be no more than 48 inches from the first one, and so on along the wall counter space (*see above*).

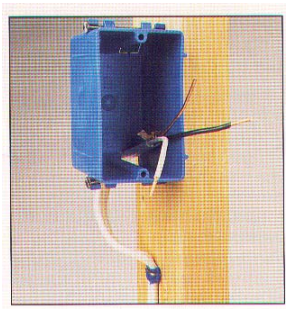
INSTALLING WIRING IN WOOD FRAMING



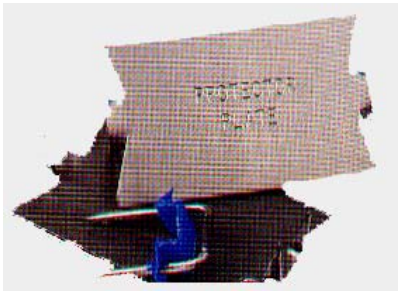
Receptacle and ceiling box installation: Choose boxes that are easy to install so that they will be flush with the finished wall surface. The most common type of boxes used in residential occupancies are the non-metallic pre-nailed "*Nail-on*" type. Position the switch and receptacle boxes at uniform heights. The most common height location from the floor is 46 - 47 inches for switches and 12 - 16 inches for receptacles. After installing the boxes, then install the NM cable (Romex) between them.



Ceiling/fixture box



Receptacle/switch box

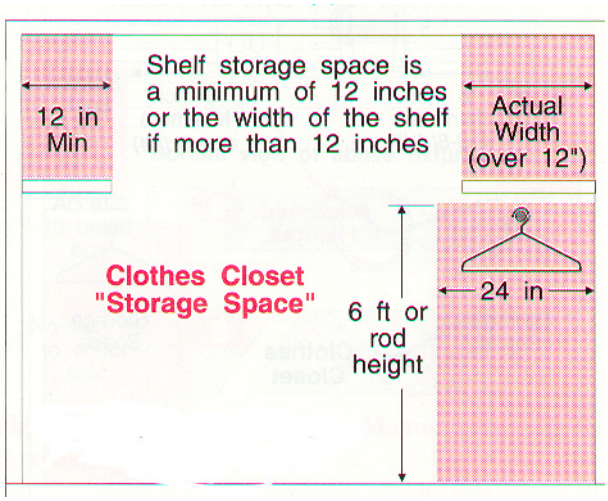


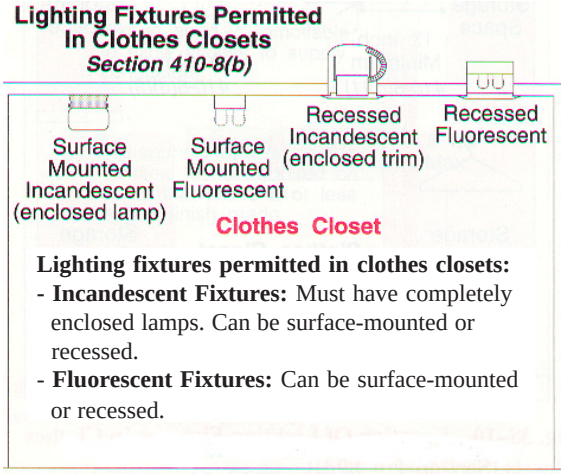
NM cable staple & Protective Nail plate

Drilling Holes in the studs: Drill holes in the center of the studs, so the edges are not less than one and one-fourth (1+1/4) inches from the edge. If the hole is closer to the edge of the stud, or if you have to make a notch instead of a hole (where wiring must go through corner framing, for example), then the NM cable must be protected from nails by installing a protective metal plate (*see above)*.

CLOTHES CLOSETS

The NEC does not require lighting outlets to be installed in clothes closets, but if a lighting fixture is installed, it must be installed properly in order to prevent the lamps from igniting combustible material. ***Definition of <u>Storage Space</u>:*** Storage space shall be defined as a volume extending from the closet floor vertically to a height of 6 feet or the highest clothes-hanging rod and parallel to the walls at a horizontal distance of 24 inches from the sides and back of the closet walls, and continuing vertically to the closet ceiling a horizontal distance of 12 inches or the width of the shelf, whichever is greater. ***<u>What did this say</u>?*** *(The drawing below explains).*

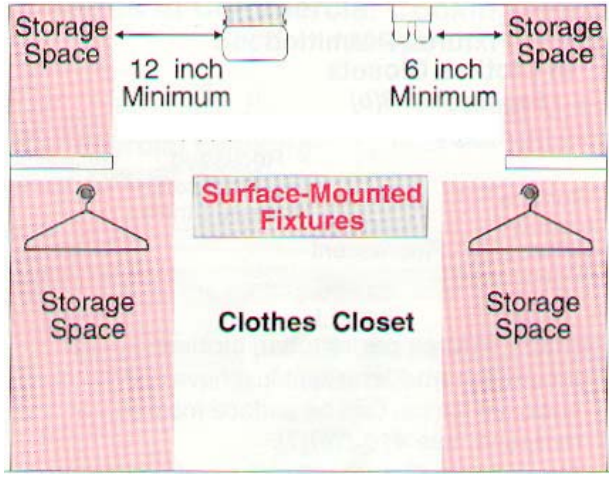


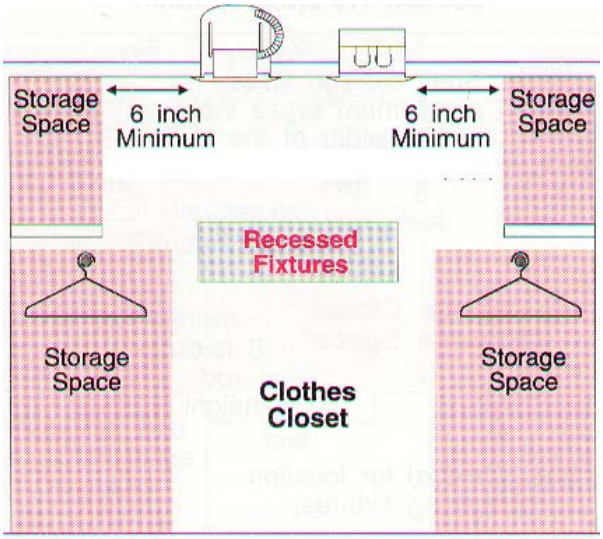


Correct Placement Of Lighting Fixtures In Clothes Closets: (***See Below***)

Surface Mounted: Totally *enclosed incandescent* fixtures must maintain a minimum clearance of 12 inches from the storage space and *surface mounted fluorescent* fixtures must maintain a minimum clearance of 6 inches from the storage space.

Recessed Mounted: Totally *enclosed recessed incandescent* fixtures must maintain a minimum clear- ance of 6 inches from the storage area, and *recessed fluorescent* fixtures must maintain a minimum clear- ance of 6 inches from the storage area.





Location Of Lighting Fixtures In Clothes Closets:

CALLING FOR THE INSPECTION

Procedure: During your plan review meeting with the inspector, you were required to submit a wiring diagram that indicated the areas where the wiring was to be installed and where the receptacles, light fixtures, switches and all other wiring were to be located. The Electrical Inspector reviewed the drawing with you, made any necessary revisions required and answered any questions that you may have had that day, and sent you home with information that would be beneficial to you during your installation. This plan review is a very important part of the procedure, because it not only benefits the homeowner, but also the inspector. Therefore, be sure and have this drawing with you when you meet with the inspector. After you install the wiring as per the drawing, you call for your inspection. *You must call your inspector at least one day in advance to schedule the inspection.* The inspector will meet you at your residence and make the inspection with you. This works very well, because ***if*** any corrections are needed, they can be pointed out and explained to you at that time. In this case, when the corrections are made, you call and reschedule another inspection.

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If you require any additional information concerning the examination process, please call.

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